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COGNITION AND THE PROBLEM OF LANGUAGE ACQUISITION.

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THE PURPOSE OF THIS PAPER IS TO DISCUSS THE POSSIBILITY THAT SOME LINGUISTIC UNIVERSALS ARE, IN FACT, THE INEVITABLE RESULT OF UNIVERSAL MENTAL CAPACITIES. ONE SUCH UNIVERSAL IS SUGGESTED, AND THE ENTIRE QUESTION IS CONSIDERED IN THE LIGHT OF CERTAIN THEORIES OF INTELLECTUAL DEVELOPMENT--MAINLY PIAGET'S, AND SECONDARILY BRUNER'S AND VYGOTSKY'S. THE CONCLUSION DRAWN IS THAT THE LIGHT IS ALL POINTED IN THE WRONG DIRECTION. THE PAPER IS BASED ON A LECTURE GIVEN TO THE INSTITUTE OF HUMAN DEVELOPMENT OF THE UNIVERSITY OF MINNESOTA, APRIL 1967, AND ALSO APPEARS IN "STUDIES IN LANGUAGE AND LANGUAGE BEHAVIOR, PROGRESS REPORT V," SEPTEMBER 1, 1967. (AUTHOR/AMM)

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Cognition and the Problem of Language Acquisition[1, 2]

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The purpose of the following paper is to discuss the possibility that some linguistic universals are, in fact, the inevitable result of universal mental capacities. One such universal is suggested, and the entire question is considered in the light of certain theories of intellectual development--mainly Piaget's, and secondarily Bruner's and Vygotsky's. The conclusion drawn is that the light is all pointed in the wrong direction.

In his recent book, Lenneberg (1967) presents a provocative idea: that language should be regarded from a biological point of view. By this he means that language should be seen as an evolutionary specialization, just as every other aspect of man's nature is seen (from a biological point of view) as the product of evolutionary specialization. As a result of innumerable selective pressures, man has evolved a particular kind of skeleton, arranged in a particular kind of way; he has evolved characteristic limitations of perception; and, as Lenneberg argues, he has evolved a specialized mode of communication--language.

As an evolutionary specialization, language is at the end of one branch of a phylogenetic tree representing the ancestry and interrelations of all systems of communication. No one knows, of course, what this tree looks like--which is to say, no one knows the natural history of communication, nor the interrelations among contemporary communication systems. But taking the biological point of view that Lenneberg urges, we take for granted the existence of such a phylogenetic tree, even though it is probably undiscoverable, and set our task as describing the exact nature of the specialization--what, precisely, occupies the homo sapiens' tip of the tree.

In the case of language, the problem of description has two aspects. One is to describe the specialization itself, the form taken by language as a communication system. Such a description is given by linguistics, and a transformational grammar is the best approximation currently available. A second aspect of the problem of description is to characterize the basis of the specialization. Why does a transformational grammar have the form it does? This description takes the form of investigating the capacity for language that man, and man uniquely, possesses.

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Descriptions of the first kind--those given by transformational grammars--raise the problem mentioned in my title: the problem of language acquistion. Descriptions of the second kind, those which provide an answer to this problem, raise another: a problem in the psychology of cognition. Each will be discussed. First, the problem of language acquisition; then a hypothesis about children's capacities for language, intended to answer this problem; and finally, the problem for cognition that this answer raises.

There are, of course, several problems of language acquisition. For instance, grammar is acquired very fast--in two or three years. Given the complexity of what children acquire, their immaturity, the poverty of the speech-sample they receive, the acquisition of language in two or three years does indeed raise a problem. However, it is not the one with which I am concerned.

My concern, instead, is with a more fundamental problem, the fact that children develop linguistic abstractions. At the end of development, at age four or so, children have knowledge of sentence structures that are entirely covert and abstract, which have never been presented to them as examples, or anything else, in adult speech. These abstractions all reside in the so-called deep structure of sentences.

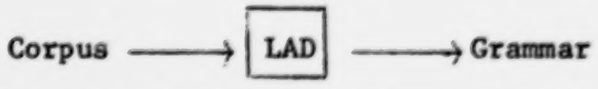
The deep structure of a sentence is that part associated with meaning. It is generally different from the surface structure--the part associated with sound. That sound and meaning are distinct, and have to do with distinct structures, is probably the most general statement about language that is still true. Examples abound. Take paraphrase, for instance: the junta destroyed freedom and freedom was destroyed by the junta have essentially the same baleful meaning. In paraphrase, the same content is expressed in different ways. Conversely, take ambiguity, where a single pattern of expression has two different meanings--outgoing tuna is my current favorite, but they are flying planes is a standard example. In the cases of both paraphrase and ambiguity, content and expression obviously differ. But, of course, the entire phenomenon of language is that they differ in every sentence. In every case, there is a deeper, abstract part associated with content, and a superficial, manifest part associated with sound. To conceive of the two as the same is to commit Colonel Blimp's error--that English (for instance) is so marvelous because the order of words is the same as the order of ideas.

Inasmuch as the deep and surface structures of sentences differ, they stand in some relation to one another, and the relation is described by transformations. The entire arrangement of deep structure, related to surface structure by means of transformations, represents how sound is related to meaning in the case of each language. In the most general and abstract way, this statement is a description of the specialized communication system that makes up human language.

The problem of language acquisition can now be stated somewhat more carefully: in developing a transformational grammar, children must develop the deep structures to which surface structures are related. But, by definition, deep structures are abstract--they are never made manifest. Only surface structures have such availability; and surface structures are different from deep structures. Hence, the problem.

Let us consider, for the moment, not children, but a hypothetical Language Acquisition Device. We can call it LAD for short (or Language Acquisition System--LAS, the feminine form).

LAD receives a corpus of speech--a set of utterances, some of which are grammatical sentences, and some of which are not. The corpus is large, but it is not unlimited in size. It contains, let us say, the number of utterances heard by a two-year-old. Given this corpus, LAD formulates a grammar--a theory about the regularities that hold within the corpus. The arrangement is like this:



If we understood LAD's internal structure--the contents of the box--we would understand how LAD develops a grammar, given a corpus.

One general requirement on LAD's structure is that it must be so arranged as to make possible the acquisition of any language. LAD should not be biased toward some languages and away from others. It should not, for reasons of internal structure, find Loma, say, easier to acquire than English or Japanese. Whatever comprises LAD's internal structure must be universally applicable--LAD may contain information bearing on the general form of language, but it must contain no information bearing on the form of any particular language.

The description of such linguistic universals is the goal of the theory of grammar--so called because it states the conditions that must be met by grammars written to describe particular languages. The theory of grammar prescribes, for example, that all such grammars must be transformational. Such is its use in linguistics.

However, the theory of grammar also can be offered as an account of LAD's internal structure. If LAD were constructed in a way described by the theory of grammar, it would contain only universal statements about language, and none about particular languages. Note that by offering the theory of grammar as a description of LAD in this way, one offers a hypothesis about LAD's structure. It is entirely an empirical question whether or not LAD can be so described.

LAD, of course, is a convenient fiction. I am not proposing to design an actual machine. On the contrary, I mention LAD to isolate certain crucial points in the acquisition of language by real children, as opposed to abstract ones.

LAD and children present the same problem. Just as LAD is confronted with a corpus of sentences, some of which are grammatical and some not, so are children. And just as LAD develops a grammar from this corpus, on the basis of some kind of internal structure, so do children. Moreover, since children and LAD produce identical grammars from the same corpora, they have the same structure. A hypothesis about LAD is ipso facto a hypothesis about children, and their capacities.

The connection between the theory of grammar and children's capacities for language is completely straightforward. Languages possess the universal features described in the theory of grammar because languages are all acquired by children, who automatically impose features on their language that correspond to their native capacities. These features thus appear universally, and the theory of grammar becomes possible.

What are some of the universals described in the theory of grammar, features that presumably reflect children's inborn capacities? Some have to do with phonology--every language, for example, employs consonant and vowel types, and every language has a sound system that can be represented by various combinations of some 15 distinctive features. Some universals may have to do with semantics--there may be, for example, universal concepts (Katz, 1966).

Within syntax, most universals have to do with the deep structure of sentences. For example, every language has the same basic syntactic categories, arranged in the same few ways--categories like "sentence," "noun phrase," "verb phrase," for example. Every language adheres to the same basic grammatical relations among these universal syntactic categories--relations such

as subject-predicate, verb-object, and modifier-head. And, to mention a third, every language maintains a distinction between deep and surface structures--and yet, relates them in certain definite ways--that is, every language is transformational.

Although every language is transformational, the transformations themselves are not. It is, instead, the types of possible relation that are universal. Languages combine these universal relations in idiosyncratic ways, thus constituting a unique set of transformational rules. Although there are vast numbers of transformations, there are only three types of transformational relation: inversion, deletion, and addition. Every transformation is one of these--or, more typically--a complex combination of the three of them. But no other, of the indefinitely many possible relations, occurs. No surface structure, for example, is its deep structure in reverse order. There is a tremendous constriction in the variety of ways that abstract deep structures are actually related to manifest surface structures. Constriction to this degree is presumably one outcome of the species--specific evolution that underlies natural language.

Let us put these various considerations together--that most universals exist in the deep structure of sentences, and that most transformations are idiosyncratic combinations of a handful of universal types of relation. Doing so, we obtain an account of how children develop linguistic abstractions.

Linguistic abstractions are those universal categories and relations that reflect children's innate capacities, and they are made abstract through the acquisition of transformations. A language is acquired when children discover the relations that hold between the surface structures of its sentences and the universal parts of its deep structures, with the latter being a manifestation of children's own capacities.

There is some evidence in support of this hypothesis. It follows, for example, that the early sentences of children should be essentially the

universal parts of the deep structure, but pronounced directly. Moreover, since linguistic diversity arises from the transformations that--on this hypothesis--very young children have not yet acquired, children exposed to different languages should show fundamental similarities in their earliest speech. Evidence is emerging that both these claims are true (McNeill, 1966; Slobin, 1966).

If the view of language acquisition outlined above is in any sense correct, a further question naturally arises: to what degree are the capacities described in linguistic theory already present in children's general intellectual development? More specifically, is it currently possible to account for the capacity for language acquisition, given what is known of intellectual development?

Before pursuing these questions, it is necessary to draw a distinction between two kinds of linguistic universals. Only one of these types is relevant. I will call them Type 1 and Type 2.

Type 1 universals are universals of language that could not possibly take any other form.

Type 2 universals are universals of language that could, logically, have some other form, but do not because of inherited peculiarities of the communication system itself.

It is not obvious under which of these types to classify the universal statements made in the theory of grammar. But the distinction is crucial to our present goal. For, clearly, only Type 1 universals are relevant to it--these are universals that could not possibly take any other form, because they are intellectual universals. Type 2 universals, on the other hand, are precisely what a cognitive theory would be mistaken to explain, for they are peculiar to language. My argument will be that cognitive theories have systematically overlooked Type 1 universals. For this reason, they provide nothing that can account for the acquisition of language as a unique system. And, I would urge, the effort to understand intellectual growth itself has been misdirected to the degree that Type 1 universals exist.

The distinction between Type 1 and Type 2 universals bears on the question of specialization in man's system of communication, but should be distinguished from it. All Type 2 universals are part of the specialization for language. Some Type 1 universals are, also, in that they appear in no

other communication system. Other Type 1 universals may appear in many places--e.g., an ability to categorize. However, those Type 1 universals that are part of the specialization for human languge, and so appear nowhere else, are aspects of his specialized cognitive apparatus, as opposed to his communicative apparatus--by the definition of a Type 1 universal. As a consequence of ignoring the possible existence of Type 1 universals, therefore, cognitive theories have systematically overlooked all specialized aspects of man's intelligence, assuming that such exist.

Later, I will suggest one potential Type 1 universal--a universal that possibly appears in language because of the nature of thought--and argue that it presents a usefully different view of intellectual development. But first I must try to demonstrate the sense in which one major cognitive theory is misdirected from the point of view of explaining language acquisition, and so possibly has overlooked an entire domain of intellectual development. The theory is Piaget's.

Piaget's period of sensory-motor intelligence conveniently coincides with the period of pre-grammatical speech. It is at18 months--at the end of the Piagetian period--that syntactic universals (such as the basic grammatical relations, and negation) are first found in the speech of children. Because of the coincidence, we can ask if there is anything in Piaget's account of sensory-motor intelligence that would make any of these linguistic universals inevitable.

The question can be answered without examining particular cases. We can avoid detail because of a more general observation: Piaget's description of sensory-motor intelligence is far too broad. It applies to processes more general than the specialized intellectual abilities that we are trying to isolate, for the phenomena that Piaget investigated can be found leading to non-language as well as language. They cannot, therefore, be Type 1 universals of the specialized sort. A young kitten is an ideal subject for Piaget's displacement experiments (Piaget, 1952). Kittens enthusiastically follow moving objects. They hunt objects when hidden, and they seem to be almost immune to discouragement. They are, in other words, like human infants. Last year, I studied one kitten in the Piagetian manner, and would like to present excerpts from the notes I made at the time.

At 1.5 months, Wil plays with a pencil I am holding. He's very much engaged, and very active. I hide the pencil under a pillow. Wil watches as it disappears, but he doesn't search. This is repeated numerous times. Sometimes he is active at the edge of the pillow, but more often he shows interest in my (now empty) hand. I play with him again, but this time, only half hide the pencil under the pillow, leaving a part visible. Wil occasionally examines the pencil, but usually seems not to notice it. Wil seems not to have an "object concept."

At 2 months, I repeat the test. At first, Wil is unable to follow the pencil when it is hidden behind the pillow. I slowly push the pencil from behind, so that it sticks out from under the pillow. Wil attacks. I quickly withdraw the pencil. Wil does nothing, at first, but after several repetitions, he finally goes around behind the pillow. We play the game again, and Wil now immediately goes behind the pillow as the pencil is removed. However, this time I hold the pencil slightly to one side, though still behind the pillow, wiggling it. But Wil attacks where the pencil had been before--seeming to look occasionally at the pencil nearby in my hand.

Slightly later, we play the game again. Wil fails repeatedly. I try withdrawing the pencil slowly under the pillow, taking care that Wil's paw is touching the pencil all the while. When the pencil is completely withdrawn, and Wil is not longer touching it, he hesitates, then dashes behind the pillow.

At 2.25 months, I repeat these tests. Wil succeeds easily, confidently going behind the pillow to retrieve the pencil. Then, as Wil tears around the screen, I place the pencil--half exposed--under a second pillow nearby. Wil looks at the pillow, but doesn't retrieve the pencil, going instead behind the first pillow. Later, during recess, Wil plays with the pencil by himself. It happens to roll under the pillow I had been using as a screen in the tests just before. Wil immediately attacks, fumbles around under the pillow, and accidentally knocks the pencil out from under the pillow. It stops about 18" away. Wil looks at it, and simultaneously searches under the pillow!

At 2.5 months, I try Wil on the pillow problem, as before. He finds the pencil easily, several times. Then, after withdrawing the pillow and before Wil has run around to the back, I place the pencil beside the pillow, directly in his path. He runs straight over it and on behind the pillow, where he looks for the pencil. He sniffs, but ignores the pencil 12" away.

Twice, I remove the pillow after hiding the pencil. Wil always retrieves the pencil.

Later, Wil plays with a balloon--chasing, hitting, pouncing on it. This goes on for several minutes, then the balloon bursts. Wil is horrified. He stares at the remains, very tense. Finally, he touches a shred, very tentatively, and immediately leaps back. It takes a half an hour to screw up his courage enough to play with a new balloon, and then only briefly. Although it is possible that it was the sound of the bursting balloon that frightened him, it is also possible that it was the sudden disappearance of an object that caused all the alarm.

Finally, at 3.5 months, I try the experiment again, withdrawing a pencil under a pillow. Wil retrieves the pencil very quickly and vigorously--sometimes leaping over the pillow. I quickly place the pencil in Wil's path, before he has run around to the back. He hesitates, first looking (but not going) behind the pillow, then attacks the pencil. This is repeated successfully several times.

Then I try a double displacement problem. I withdraw the pencil under a pillow, about 12" to Wil's right. The pencil is visible as I transport it, but it is completely hidden under the second pillow. Wil goes behind the first pillow, hesitates, then attacks under the second. This is repeated twice, with success.

I try an invisible displacement problem, cupping another, smaller, pencil in my hand as I transport it from the first to the second pillow. Wil looks only under the first pillow, never under the second. This is the case, despite the fact that he had just before searched under the same second pillow, after a visible displacement of the pencil. I try this three times, and Wil continues to look behind the first pillow, but with declining enthusiasm. Possibly the pencil is too small (it's a mere stub), but since he persistently looks for it behind the first pillow, he should look for it behind the second, if he knew it was there. On the other hand, by this time, Wil is dispirited, and fails to solve even a visible displacement problem.

Piaget's observations of his own children during the first 18 months of life are brilliantly accurate--I can reproduce them even with a cat. But this is the rub. It is obvious that the steps children follow in attaining an object concept, since they are also followed by cats, do not constitute specialized

Type 1 universals. Intellectual characteristics shared by kittens and infants cannot be used to describe the homo sapiens' tip of a phylogenetic tree. The development of sensory-motor intelligence evidently leaves out what we seek.

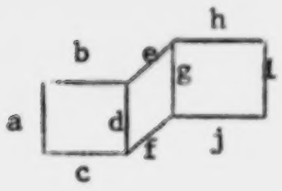
I can mention in passing two other cognitive theorists, Bruner (1966) and Vygotsky (1963). I have but one observation, which, despite the differences between them, applies to both. Both Vygotsky and Bruner are interested in the influence of language on thought, Vygotsky through the formation of inner speech, and Bruner through the formation of symbolic representation. Whatever inner speech and symbolic representation actually are, they must be just the opposite of Type 1 universals. Type 1 universals exist because of intellectual abilities, whereas symbolic representation and inner speech are proposed precisely to fill gaps in intellectual abilities, however these are conceived. These two interesting efforts, then, are certainly pointed in a direction different from Type 1 universals.

My conclusion, which I believe to be fair, is that no current theory of cognitive development can account for the specialized abilities that make language possible. In every case, attention has focused elsewhere. Piaget's interests, in the sensory-motor period at least, have been in features of intelligence that apply broadly, too broadly for our purposes. Bruner's and Vygotsky's interests, on the other hand, have been in the "parasitical" use of language by thought. No one has discussed the intellectual features, if such there are, that give language the specialized character it has.

I would now like to suggest one possible Type 1 universal. It is the capacity to relate abstract structures to superficial structures, and it is worth considering only because there are many examples of such relations outside of language. If indeed the capacity to relate abstract and superficial structures is a Type 1 universal, it would explain why languages are all transformational. And it would suggest that an appropriate view of cognitive development would regard it as the emergence of a transformational system of some kind. It is impossible to say from the examples below whether or not transformations are specialized Type 1 universals.

There are nonetheless a number of scattered facts suggesting that the capacity to discover transformations is a Type 1 universal. Various kinds of ambiguous figures, for example, are paralleled by various kinds of ambiguous sentences. Just as ambiguous sentences reflect a distinction between expression and content, so do ambiguous figures.

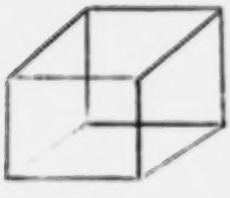
There are, first of all, ambiguous figures exactly like sentences with surface structure ambiguities.



( ) ( ) ( )
They are cooking apples
( ) ( ) ( )

In both the sentence and the figure, different underlying structures are related to different surface bracketings of the same superficial elements--lines or words, as the case may be. In both cases, the surface bracketing is reversible, and spontaneously alternates between one organization and the other. In the sentence, it is as indicated. In the figure, under one view, line d appears to be a corner, and associated with it are lines b, c, and e, f. Under the other view, line g is the corner, and associated with it are lines h, i, and e, f. Lines e, f, therefore, play the same role in the figure as the word cooking plays in the sentence--allegiance changes according to the underlying structure--left- or right-hand cube, an object or activity.

There are also ambiguous figures like sentences with deep-structure ambiguities. A deep-structure ambiguity is one in which the surface bracketing remains the same, although there are two distinct deep structures related to the single surface structure. A linguistics example is flying planes can be dangerous. A perceptual example is the Necker cube:



Flying planes can be dangerous
( ) (( ))

Unlike the first figure or sentence, these two have just one surface organization. But they are ambiguous nonetheless. There is an alternation of deep structures--cubes or meanings--but no possible alternation of surface structures.

A more compelling example of the similarity between figures and sentences--with respect to transformations at least--are cases where transformational rules are violated--yielding impossible sentences or figures. They are more compelling because they suggest that perceptual transformations must obey rather definite restrictions--as do linguistic transformations. Let me take up the linguistic side first, and consider sentence-embedding. In English, as in any language,

one can recursively place sentences within sentences. Consider, as an example, someone bought the book that you wrote, the result of inserting you wrote the book into someone bought the book. A set of transformations relates the two deep structures involved--the one inserted into the other--to a surface structure containing the relative pronoun, that. A principal transformation in this case is deletion, and its application is restricted to cases where the objects of the verbs in the two deep structures are the same. In the case of you wrote the book and someone bought the book, this condition is met. The transformation therefore applies, the second book is deleted and replaced by that--the relative pronoun for inanimate nouns--and someone bought the book that you wrote comes out.

But note what happens when the restriction on the application of this transformation is violated. Suppose we insert the deep structure of you met him into the deep structure of someone bought the book. In this case, the transformation cannot apply--the objects of the verbs of the two sentences are not the same--him in the first, book in the second. However, suppose that we force the transformation, and relate the two deep structures to a surface structure in the way described by the transformation. Suppose we do this even though the deep structures so related fail to make a proper combination. The result is an impossible sentence--someone bought the book whom you met.

An exactly comparable violation exists for figures, resulting in an impossible surface structure--one that does not relate to a coherent deep structure. Such violation of the conditions on transformations has become an artistic vogue in recent years:

In this figure, as in someone bought the book whom you met, there is no alternation--there is instead a lack of closure, a failure to recover a deep structure.

Thus, one reason to suppose that intellectual--or in this case, perceptual--development is analyzable as the emergence of a system of transformations is that figures, such as the ones just described, present the same properties as sentences, at least with respect to the distinction between an abstract deep structure and a manifest surface structure.

Other considerations point in the same direction. For example, it is uniformally agreed that young children--three to six years old--are dominated by

perceptual, as opposed to conceptual, experience. Little children are distractible. They flit from the brightest to the loudest to the smelliest object around them. They are also liable to become perceptually stuck--centered on the perceptually pre eminent part of a scene. In general, children are said to be focused on the superficial appearances of things, and it is only their later development that rescues them, by giving them something else to think about.

Let me suggest, however, that psychologists themselves have been caught by surface appearances, and that just the opposite may be the case. The difficulty for young children may not be that they are focused on the superficial appearance of things, but that they are unable to relate superficial appearances to abstract concepts--which is to say, they have yet to discover a set of perceptual transformations.

Their problem, perceptually, may be like their problem, linguistically, when dealing with a passive sentence. A child who does not yet know the passive transformation will point, when hearing <u>the truck was pushed by the car</u>, to a picture of a truck pushing a car, as if he had processed only the surface structure. But this misstates the case. Actually, such a child has paired the surface structure of <u>the truck was pushed by the car</u> with the <u>wrong</u> deep structure. Similarly for perceptual superficiality; it may not be so much an inability to escape the appearance of things, as an inability to relate surface appearances to correct underlying structures.

I believe this possibility can be pursued in various directions. Doing so suggests a very different view of intellectual development--namely, that much of what passes for the primitive conceptualization of children may, instead, be an ignorance as to how abstract (and perhaps advanced) conceptualization is related to the vagaries of perception.

One example of the difference of interpretation I have in mind lies in the treatment of conservation. The problem for a young child, according to Piaget, is to avoid centration--something he cannot do until the several notions of reversibility have been developed.

But the phenomenon of conservation is an ideal example of a transformational relation. In conservation, different appearances are related to the same underlying quantity. The notion of quantity is necessarily abstract--it is always related to, but not identified with, a particular configuration--a surface appearance. But if this is correct, then the ideas of inversion and compensation--Piagetian reversibility--are surely quite peripheral. They miss

completely the special abstract quality of conservation that would, were it language, call for a transformational grammar. Both inversion and compensation are relations between surface structures, not relations between surface and deep structures. Inversion is the interconvertibility of one surface structure to another. Compensation is a relation between the attributes of different surface structures--a child appreciates that the height of one container is compensated by the diameter of the other, etc.

The use of reversibility as an argument (by children) in support of conservation may not therefore await the discovery of inversion and compensation, but rather, it may depend on the deeper discovery of how to relate an abstract notion of quantity to any surface appearance. The situation is analogous, perhaps, to paraphrase--which is conservation of meaning. A child who understands that the truck is pushed by the car and the car pushes the truck mean the same thing has not learned a special paraphrase relation, whereby Aux and the preposition by compensate for a change in word order. Instead, he has learned how to relate two surface structures to their correct deep structures, which happen--in the case of a paraphrase --to be semantically the same. The same, I suspect, can be said of conservation of volume, weight, and the rest. It is for this reason, presumably, that children can cite compensation in support of non-conservation as Bruner (1966) has recently observed. "The amount of water is different because the glass is taller and thinner." Just as "The two sentences can't mean the same because one has a by in it and the other does not." When pressed, children will say anything.

One final observation: as noted before, linguistic transformations are striking in that they involve so few relations--inversion, deletion, and addition are the only ones. Thus, for example, no surface structure consists of the deep structure in reverse order, or of every other element of the deep structure, or of the square of the number of elements in the deep structure. Such relations are logically possible, but do not exist in language. (This misstates the constraint more or less seriously, since any relation can be expressed as a combination of inversion, deletion, and addition. The excluded relations either surpass some limit on complexity, or violate some other, as yet unknown, constraints on the combination of elementary relations.)

Constriction to this degree presumably is one aspect of man's specialized capacity for language. We would like to know--continuing to ask the question

we have asked all along--if such specialization is a Type 1 universal, one that inevitably arises in language because it is a universal of thought.

In this context, I find it interesting that mental tests often use just these excluded relations--such as series in reverse order, series that progress by the square, etc. But mental tests never use the included relations--inversion, addition, and deletion. Mental tests are organized in the way they are because the excluded relations are difficult, and people differ in the ease with which they deal with them, whereas the included relations are easy, and people do not differ in their ability to use them. It is, in fact, very much as if addition, inversion, and deletion were the common property of all men, and thus were candidate Type 1 universals.

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Footnotes

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